

SCH3U Grade 11 Chemistry - Units of Concentration (v/v, w/v, w/w and ppm)

These units of concentration are most often seen and used with commercial products. Expect for 'ppm' they are not used often in the lab.

Percent Concentration Volume/Volume (v/v): used with 2 liquids.

$$\% \text{ Concentration} = \frac{V_{\text{solute}}}{V_{\text{solvent}}} \times 100\%$$

eg. 5 mL of vinegar are dissolved in 100 mL of vinegar solution. What is its v/v concentration.

$$\% \text{ concentration} = \frac{5 \text{ mL}}{100 \text{ mL}} \times 100\% = 5\%$$

eg. A photographic stop bath contains 140 mL of pure acetic acid in a 500 mL bottle of solution. What is the v/v concentration?

$$\% \text{ concentration} = \frac{140 \text{ mL}}{360 \text{ mL}} \times 100\% = 38.9\%$$

Percent Concentration Weight/Volume (w/v): used with one solid and one liquid

This means there is a certain mass, in grams, in every 100 mL of solution.

eg. a 3% H_2O_2 topical antibiotic solution means that there is 3 grams of H_2O_2 in every 100 mL of solution.

Percent Concentration Weight/Weight (w/w): used with two solids

Useful when dealing with alloys of precious metals.

eg. A ring with a mass of 12.0 grams contains 11.1 grams of pure silver. What is the w/w%?

$$\% \text{ concentration} = \frac{11.1 \text{ grams}}{12.0 \text{ grams}} \times 100\% = 92.5\% \text{ w/w of silver}$$

Parts per Million Concentration (ppm)

Environmental solutions are often very low in concentration. We often use terms like:

1 part per million (ppm): 1 part out of 1×10^6 parts

1 part per billion (ppb): 1 part out of 1×10^9 parts

1 part per trillion (ppt): 1 part out of 1×10^{12} parts

1 ppm = 1 drop in a full bathtub

1 ppb = 1 drop in a full swimming pool

1 ppt = 1 drop in 1000 full swimming pools

We express ppm concentration in a variety of units depending on what we need to use. But they are all interrelated.

$$\text{ppm} = \frac{1 \text{ g}}{10^6 \text{ mL}} = \frac{1 \text{ g}}{1000 \text{ L}} = \frac{1 \text{ mg}}{1 \text{ L}} = \frac{1 \text{ mg}}{1 \text{ kg}} = \frac{1 \text{ microgram}}{1 \text{ g}}$$

eg. Dissolved O_2 in water shows a concentration of 250 mL of water At SATP and 2.2 mg of O_2 . What is the concentration in ppm?

$$\text{ppm concentration} = \frac{1 \text{ mg}}{1 \text{ L}} = \frac{2.2 \text{ mg}}{0.25 \text{ L}} = 8.8 \text{ mg/L} = 8.8 \text{ ppm}$$

Go to the Concentration Unit Calculations Other than Molarity Worksheet

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